AGRICULTURE MARKETING AND INFORMATION SYSTEM

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ABSTRACT

Agriculture is vital to India's global economy and significantly contributes to GDP. As the human population grows, the nation's agricultural output is crucial in ensuring food security. Climate factors such as temperature, precipitation, soil quality, and fertilizers primarily influence a crop's yield. The variability of these elements adversely impacts productivity, posing a significant challenge for the agriculture industry to accurately estimate crop yields under fluctuating climatic circumstances. Recently, researchers have used machine learning algorithms to forecast crop yields before actual planting. This research study has introduced a machine learning technique, namely linear regression and multilayer perception, to forecast crop production based on characteristics such as state, district, area, seasons, NPK, pH values, rainfall, temperature, and area. To improve yield, this research study recommends a fertilizer tailored to soil conditions, including NPK levels, soil type, pH, humidity, and moisture. Fuzzy algorithms primarily guide the recommendation of fertilizers.

KEYWORDS

Crop Yield Prediction, Machine Learning, Crop Recommender System, Artificial Neural Networks (ANN), Logistic Regression , Agro-Information System , Smart Farming, Web- based Application, HeidiSQL Database, Precision Agriculture , Crop Price Monitoring , Farmer Support System , Market Price Updation , Agriculture Chatbot.

INTRODUCTION

The advancement of information exchange in evolving technologies will enable agriculturists to recognize and cultivate their potential. Agriculturists share information that is useful and timely, either officially or informally. The readiness to disseminate knowledge denotes a receptive disposition among agriculturalists. This open disposition influences the extent and breadth of information dissemination. We develop the online application using web technologies such as HTML and CSS. We create a dataset by aggregating information from many sources, using it to predict Crop recommendation and crop yield, and then applying non-

linear analysis to the results. As a result, we establish priorities and assign ranks to the fertilizer list. We enter data into our program and distribute it to farmers, from whom we collect and store data on the MySQL server. Our program autonomously transmits the updated information to the agriculturalists by text message. This obviates the need for agriculturists to go to adjacent towns and cities for current information. Over the following two months, we will use machine learning algorithms to forecast Crop

recommendation and crop yield. We will use machine learning techniques to anticipate future crop yields for agricultural usage. We also include a ranking procedure in the decision-making process to determine the classifiers' outcomes.

Agriculture serves as a vital source of revenue for several individuals in developing nations. Numerous technologies, climates, habits, and civilizations have together impacted agricultural growth in recent years. Moreover, the use of information technology may transform decision- making, enabling farmers to achieve optimal outcomes. The decision-making process utilizes data mining methods pertinent to agriculture. Data mining is the process of extracting significant and relevant information from extensive databases. We currently use a machine learning methodology for predicting crop or plant yields, taking into account the many data points associated with agriculture, such as soil, crop, and meteorological information. We effectively use machine learning methodologies to develop a crop recommendation and yield prediction system.

PROBLEM STATEMENT

Despite advancements in agriculture, many farmers continue to face significant challenges in making informed decisions regarding crop selection, yield expectations, and market access. Lack of timely and localized information leads to inefficient farming practices, lower crop yields, and poor market returns. Additionally, limited direct access to customers restricts farmers' ability to sell their produce at fair prices, often making them dependent on middlemen.

There is a need for a comprehensive Agriculture Marketing and Information System that integrates intelligent crop recommendation, accurate crop yield prediction, real-time market price updates, and a platform for direct farmer-to-customer sales. Such a system can empower farmers with data-driven insights and direct market access, thereby improving productivity, profitability, and transparency in the agricultural value chain.

MOTIVATION

The motivation behind agriculture stems from the recognition of the challenges farmers face in traditional agricultural practices. Agriculture should not lag behind in this technologically advanced era. The project aims to empower farmers with tools that leverage machine learning, crop recommendation, and crop price forecasting to provide them with critical insights. The vision is to alleviate the uncertainties farmers encounter, offering them a technological ally that simplifies decision-making, optimizes resource utilization, and

ultimately enhances their livelihoods. Agri-Venture is not just a project; it's a response to the evolving needs of the agriculture sector, driven by the motivation to make farming more efficient, sustainable, and resilient in the face of unpredictable variables.

OBJECTIVES

- To help farmers easily to sell their products to buyers or directly to customers.
- To make sure farmers get a fair price for their crops by reducing middlemen or helping them understand market prices.
- To introduce farmers to online platforms to sell their products faster and reach more customer.
- To validate and explore the system classification results with existing detection techniques.

LITERATURE REVIEW

According to [1] CYP using machine learning approaches distinct from the features, and the current evaluation included numerous factors that are fundamentally dependent on data availability. The availability of the informational collection largely influenced the identification of the highlights, but the incorporation of additional features did not always yield superior outcomes. The selection of components was contingent upon land acreage, dimensions, and harvest characteristics. Therefore, we analysed and used the qualities with the lowest performance in the evaluations. Most contemporary models for CYP included neural networks, random forests, and KNN relapse procedures; however, a variety of machine learning techniques were also utilized for optimal prediction. The investigation revealed that CNN, LSTM, and DNN were the most often used algorithms; nevertheless, CYP still required more development.

According to [2] the method amalgamates many data points, including soil attributes (pH, nutrient concentrations), meteorological variables (temperature, precipitation, humidity), and historical crop production statistics to suggest the optimal crop for a particular locale. We assess various machine learning methods, including decision trees, random forests, and support vector machines (SVM), to determine the most precise model for crop recommendation. We use techniques for feature selection and extraction to identify critical criteria affecting crop selection.

According to [3] the Python Flask framework forms the basis of the website. We develop the predictive model for the back end using machine learning methods. Developing a predictive model entails data gathering, data cleansing, model construction, validation, and deployment. The objective is to provide an intuitive interface for farmers, and this model must reliably forecast crop output and price based on the supplied real-time data. The built-in prediction system must accept user inputs and provide the most accurate predictive analysis for crop

production and anticipated market price, considering location, soil type, and other variables. The website offers information on the most suitable crops for certain soil and weather conditions. The design of the web page must be sufficiently interactive to assist farmers.

According to [4] Worldwide, researchers are attempting to find ways to predict agricultural yields with more precision and efficiency, allowing farmers to better prepare for what lies ahead. The primary goals of the research are as follows: (a) to investigate the available machine learning methods for predicting agricultural yields; (b) to evaluate the performance of more sophisticated methods, such as deep learning, for making such predictions; and (c) to investigate the efficacy of hybridized models that incorporate more than one method. The evaluations conducted have shown a strong preference for using deep learning methods and hybrid models to forecast agricultural yields. Temperature and precipitation were shown to have the greatest impact on agricultural yields across a variety of crops, according to the study's examination of data on the topic. Climate is only one of many elements that affects crop output; agronomic procedures used by farmers at different points in a plant's life cycle also have a significant role.

According to [5] crops that are both economically viable and, in comparison to current classifiers, provide superior prediction. One effective model for predicting agricultural productivity and crop diseases is the ensemble classifier that has been suggested. For farmers, our planned study means learning which weather patterns are most likely to cause crop diseases and which ones will result in higher yields. Although it finds crop infections and agricultural yields, it doesn't focus on how to fix the productivity problem that crop dis- eases produce.

According to [6] analysis of crop yield prediction utilizing artificial intelligence approaches, as well as a systematic study that extracts and synthesizes the characteristics needed for CYP. Additionally, many methods have been created for this purpose. The main drawbacks of using a Neural Network for crop yield

prediction are its reduced relative error and its reduced prediction efficiency. Similarly, when it came time to grade or sort fruits, supervised learning methods failed miserably at capturing the nonlinear relationship between input and output variables. Several research were suggested for the advancement of agriculture with the aim of developing a reliable and effective model for crop classification, including weather-based crop yield estimate, disease-based crop classification, and growth-phase-based crop classification, among others.

According to [7] a model that uses ML methods (such as Decision Tree, Artificial Neural Network, and Ran- dom Forest) to find the optimal crop. By incorporating deep learning methods into the proposed model, this research improves its ability to forecast crops and provides detailed information on the quantities and costs of soil elements. It outperforms the current model in terms of accuracy. By analysing the provided data, it aids farmers in making profit-generating crop predictions. Proper yield prediction takes into account the meteoro- logical and soil parameters of the area. The goal is to showcase a system that is built on Python and employs techniques intelligently to predict the most productive harvest under certain circumstances while keeping ex- penditures to a minimum. While LSTM and RNN are used as Deep Learning algorithms in this research, SVM is utilized as a Machine Learning method.

According to [8] we have selected the Mysore area for the forecast of crops such as sugarcane, rice, and ragi in Crop Yield forecast. The agricultural output of the Mysore area is forecasted using data on rainfall, pressure, and temperature from 1997 to 2014. One of the most common machine learning algorithms used to forecast yield is the Multiple Linear Regression approach. The projected and actual numbers are shown on a graph to show the outcome of the prediction. We were able to get an annual crop accuracy of 72% and a seasonal crop accuracy of 91% using our models. Farmers may benefit from Crop Yield Prediction by cultivating crops that provide higher yields, as predicted by algorithms. As a result, it aids in reducing farmers' loss. Extending the financial set-up is another benefit of prediction.

According to [9] For datasets of six fields in Atlantic Canada, four ML algorithms—LR, EN, k-NN, and SVR—were evaluated for their ability to forecast potato tuber production. Soil electrical conductivity (both horizontal and vertical components), soil moisture content (SMC), field slope, soil pH, soil organic matter (SOM), normalized difference vegetative index (NDVI), and potato tuber yield (PE-2017, PE-2018, NB-2017, and NB-2018) were measured for fields in Prince Edward Island and New Brunswick during the 2017 and 2018 growing seasons, respectively. We used modelling approaches to extract statistical factors from the data and use them to develop yield projections. With RMSE values of 5.97, 4.62, 6.60, and 6.17 t/ha, respectively, the SVR models were the most effective for each of the four datasets.

According to [10] a model for predicting agricultural productivity using deep recurrent neural networks, which is an optimization of the Q-Learning reinforcement learning method. A Recurrent Neural Network's data parameters feed the network's successively stacked layers. Using the given parameters as input, the Q-learning network builds an environment for predicting crop yields. A linear layer converts the values of the Q-values from the Recurrent Neural Network outputs. To aid in crop production prediction, the reinforcement learning agent uses a threshold in conjunction with parametric parameters. Ultimately, the agent is given a final score based on their behaviours, which aim to maximize prediction accuracy while decreasing mistake.

According to [11] an algorithm for forecasting agricultural yields using historical data. Crop output is anticipated with the use of data mining tools. In this case, we are anticipating the optimal harvest yield by means of the Random Forest method. For the most part, crop production prediction works well in the agricultural sector. The benefit to the crop output increases as the degree of precision rises. The suggested method aids farmers in becoming aware of the demand for and cost of various crops. As a result, farmers are better able to choose which crops to grow. The benefit to the crop output increases as the degree of precision rises. In order to find out more about the crop and how to harvest it efficiently and effectively, this task is done.

According to [12] finds out how much of almost every crop grown in India will produce. This script is unique because it allows the user to forecast the crop's yield in whatever year they choose using just a few basic parameters: state, district, season, and area. The research employs state-of-the-art regression methods such as ENet, Kernel Ridge, and Lasso to forecast yield, and then applies the idea of Stacking Regression to improve the algorithms even more. Based

on our research and previous studies, it has been found that climatic factors such as rainfall and sunshine, as well as agricultural factors like soil type and soil nutrients (such as potassium and nitrogen), are all used. The catch is that in order to make predictions, we have to collect data, have it explained to the farmer, who then has to put in a lot of work without understanding the science behind these factors.

COMPARISION

Artificial Neural Networks (ANNs) have emerged as a powerful tool in agriculture due to their ability to model complex, non-linear relationships between various environmental, soil, and crop features. When compared to traditional algorithms like Logistic Regression, Decision Trees, and Support Vector Machines (SVMs), ANNs offer several advantages, especially in scenarios where large datasets and intricate patterns exist.

Compared to **Logistic Regression**, which is a linear model suitable for binary classification tasks, ANNs can handle multi-class and continuous predictions more effectively. Logistic Regression performs well when the relationship between inputs and outputs is linear and the data is limited. However, agriculture data is often non-linear and influenced by multiple interdependent variables such as rainfall, pH, temperature, and nutrient levels. ANN handles this complexity better, enabling more accurate crop recommendations and yield predictions.

When evaluated against **Decision Trees**, ANNs outperform in terms of predictive accuracy and robustness. Although Decision Trees are highly interpretable and easy to visualize, they tend to overfit the training data and may not generalize well. In contrast, ANNs—especially when regularized properly—can generalize effectively, capturing hidden trends across large and varied datasets. This makes ANNs particularly useful in real-world agriculture systems where variability in data is common.

Compared to **Support Vector Machines (SVMs)**, ANNs are more scalable and adaptable. While SVMs are effective for high-dimensional classification problems and perform well with smaller datasets, they require careful tuning of hyperparameters and are computationally expensive for large datasets. ANNs, on the other hand, are well-suited for large-scale applications, can be optimized using modern deep learning frameworks, and can learn complex mappings without extensive manual feature engineering.

In conclusion, ANN is more beneficial in agricultural applications due to its **high adaptability, capacity to learn non-linear and complex relationships, and ability to scale with large datasets**. This makes it particularly useful for building intelligent systems for **crop recommendation, yield prediction, and decision support**, where traditional models may fall short in capturing the intricacies of agricultural data.

METHODOLOGY

The proposed system, "Agriculture Marketing & Information System," is designed to assist farmers in making informed decisions regarding crop selection, yield forecasting, market prices, and real-time support. The methodology follows a structured modular approach comprising data collection, model development, integration, and web implementation.

Module 1: Crop Recommendation System

- **Objective:** To suggest the most suitable crop based on environmental and soil conditions.

- **Method:**

  o Utilized an **Artificial Neural Network (ANN)** model.

  o Input parameters include Nitrogen (N), Phosphorus (P), Potassium (K), temperature, humidity, pH, and rainfall.

  o The ANN model is trained using historical data from reliable agricultural datasets.

  o The system processes input values and recommends an optimal crop with high yield potential.

Module 2: Yield Prediction

- **Objective:** To predict the yield of a crop based on selected parameters.

- **Method:**

  o Applied **Logistic Regression** for yield classification.

  o Input variables are similar to the crop recommendation module.

  o The model is trained to predict whether the expected yield will be high or low.

  o This enables farmers to make planting decisions that minimize risk and maximize productivity.

Module 3: Chatbot

- **Objective:** To offer real-time assistance and answer agricultural queries.

- **Method:**

  o Implemented using **Natural Language Processing (NLP)** techniques.

  o Designed to handle common questions related to farming practices, fertilizers, pests, etc.

 o Enhances user experience and supports farmers with instant responses.

Module 4: Market Price Updation

- **Objective:** To provide up-to-date information on market prices of various crops.

- **Method:**

  o The system is integrated with a database (HeidiSQL) that maintains daily crop price records.

  o Admin can manually update the prices to reflect the latest market trends.

  o The data is dynamically displayed on the frontend using JavaScript and PHP.

Web Development and Integration

- **Frontend Technologies:** HTML, CSS, JavaScript were used to build a user-friendly interface.

- **Backend & Database:** PHP and HeidiSQL were used for backend logic and database management.

- **Deployment:** All modules are integrated into a centralized web platform, accessible to users via a simple dashboard.

SYSTEM ARCHITECTURE
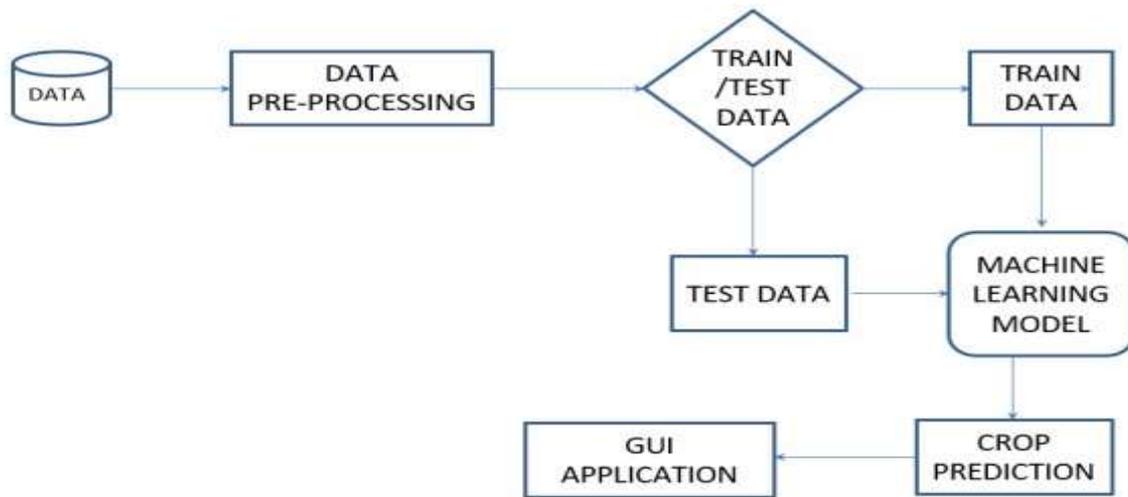
The system architecture of the Agriculture Marketing & Information System is modular and web-based, designed to integrate multiple functionalities into a unified platform. It consists of four main modules: Crop Recommendation, Yield Prediction, Chatbot, and Market Price Updating. User inputs (such as soil nutrients, temperature, and rainfall) are collected via the frontend and processed by machine learning models like ANN and Logistic Regression. The backend, built using PHP, handles data processing and model interaction, while the HeidiSQL database stores user inputs, crop data, and market prices. The chatbot uses NLP techniques to

provide real-time responses. All modules are accessible through a web interface, offering farmers a simple and efficient decision-support tool.

FUTURE SCOPE

The Agriculture Marketing & Information System has significant potential for future enhancements. One major improvement could be the integration of real-time sensor data from IoT devices for soil moisture, weather, and crop health monitoring. Additionally, incorporating satellite imagery and GIS data can enhance the accuracy of crop and yield predictions. The system can also be expanded to support regional languages and voice-based interaction for better accessibility by local farmers. Further automation of the market price updates using government APIs or web scraping techniques can ensure fully real-time pricing. Integration with e-commerce platforms for direct crop selling and mobile app development will make the system more versatile and accessible to a wider user base.

CONCLUSION

In conclusion, the Agriculture Marketing & Information System effectively addresses key challenges faced by farmers, such as lack of crop planning, poor yield forecasting, and dependence on middlemen. By utilizing Artificial Neural Networks and Logistic Regression, the system offers intelligent crop recommendations and accurate yield predictions. The chatbot and price updation modules further enhance the usability of the platform by providing timely support and market insights. The user-friendly web interface ensures that even non-technical users can benefit from the system. Overall, this project demonstrates how data-driven approaches can empower farmers, increase productivity, and improve profitability in the agricultural sector.

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